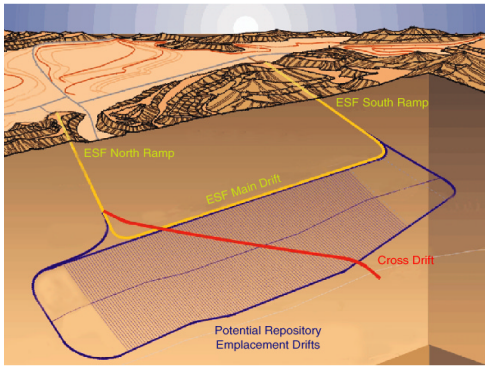
Working miles and miles underground…

By EES-7 staff

Field studies have played a major role in the Yucca Mountain Project site characterization since the 1970s. They have ranged from the initial surface-based borehole studies beginning in the 1970s; to tests being conducted in the ESF, an elaborate underground facility built at the site in the late 1990s; to various remote sites around the Yucca Mountain region, which are continuing today. To build over 6 and a half miles of tunnel beneath the remote desert of Southern Nevada took massive, specialized equipment and the trained, experienced staff of EES-7 to ensure that the facility being designed, constructed and operated met the precise needs of a large multi-disciplined scientific community.

The Exploratory Studies Facility

In the late 1980's and early 1990's, the YMP began planning to cite an underground test facility, which would be used to conduct experiments to further characterize the unsaturated zone (UZ) above and within the potential repository horizon. The facility was termed the Exploratory Studies Facility (ESF).



Several design alternatives were evaluated, including many different shaft and ramp-type tunnels; the design selected was the ramp type consisting of a north ramp, main drift, and south ramp. In Figure 2 we see the ramps of the ESF, bordered by the potential repository.

ESF construction began in 1994 and was completed in 1997; the 5-mile loop was excavated using a 25-foot-diameter tunnel-boring machine (TBM). In Figure 3 we see the cutter head of the TBM piercing through the rock after completing the excavation of the ESF. The TBM tunneled through rocks of the Tiva Canyon, paintbrush Nonwelded (PTn), and upper parts of the Topopah Spring Formations. EES-7 staff worked on and around the TBM during all shifts to ensure that construction activities and use of construction materials such as grout and water did not interfere with potential testing locations. The staff also would help collect rock samples and provide other testing needs such as holes used for instrumentation installation from the back platforms of the TBM.

Numerous research activities have been conducted in the ESF. They include geologic mapping, construction monitoring, and systematic sampling and characterization of the hydrologic, mineralogic-petrologic, thermal-mechanical, and geochemical properties of the stratigraphic units in the UZ. A series of alcoves and niches were excavated in the ESF so more specific experiments to further characterize hydrologic processes and thermally coupled processes could be conducted.

The Cross Drift

One of the limitations of the ESF is that it does not expose the majority of the potential repository horizon rocks (most of the Topopah Spring Lower Lithophysal unit and the entire Topopah Spring Lower Nonlithophysal unit). Based on these limitations and numerous interactions with external oversight bodies (particularly the Nuclear Waste Technical Review Board), the YMP initiated a planning effort, termed the Enhanced Characterization of the Repository Block (ECRB), in 1997.

This effort was aimed to plan a way to further characterize the potential repository block. The result of this effort was the construction of an additional tunnel (termed the Cross Drift) across the potential repository block to expose the potential repository horizon units and the Solitario Canyon Fault Zone. The Cross Drift is shown in Figure 2.

Construction of the Cross Drift started in late 1997 and was completed in October 1998. A 16.5-foot-diameter TBM was used this time for the excavation. In Figure 4 we see the 16.5-foot diameter TBM being moved into position to begin excavating the Cross Drift. As before, EES-7 staff on and behind the machine to ensure test criteria was being met. Initial activities in the Cross Drift included geologic mapping, systematic sampling and analyzing hydrologic and geochemical properties, and hydrologic monitoring.

As in the ESF, a series of testing alcoves and niches are being developed for the Cross Drift over the next couple years. These studies will address flow, transport, and seepage properties. Thermally coupled processes within the potential repository horizon rocks and the hydrologic properties of the Solitario Canyon Fault Zone will be studied.

EES-7 (Geotechnical Engineering and Research)

The mission objectives of EES-7 (Geotechnical Engineering and Research) will continue to be providing a sole-source, comprehensive resource for concept refinement, prediction, and ultimately, detailed planning and implementation of underground and surface geotechnical testing and system installations. These systems will be on the YMP, as the case with the ESF and Cross Drift, as well as other underground and surface-based testing installation on the Nevada Test Site and potentially Los Alamos.